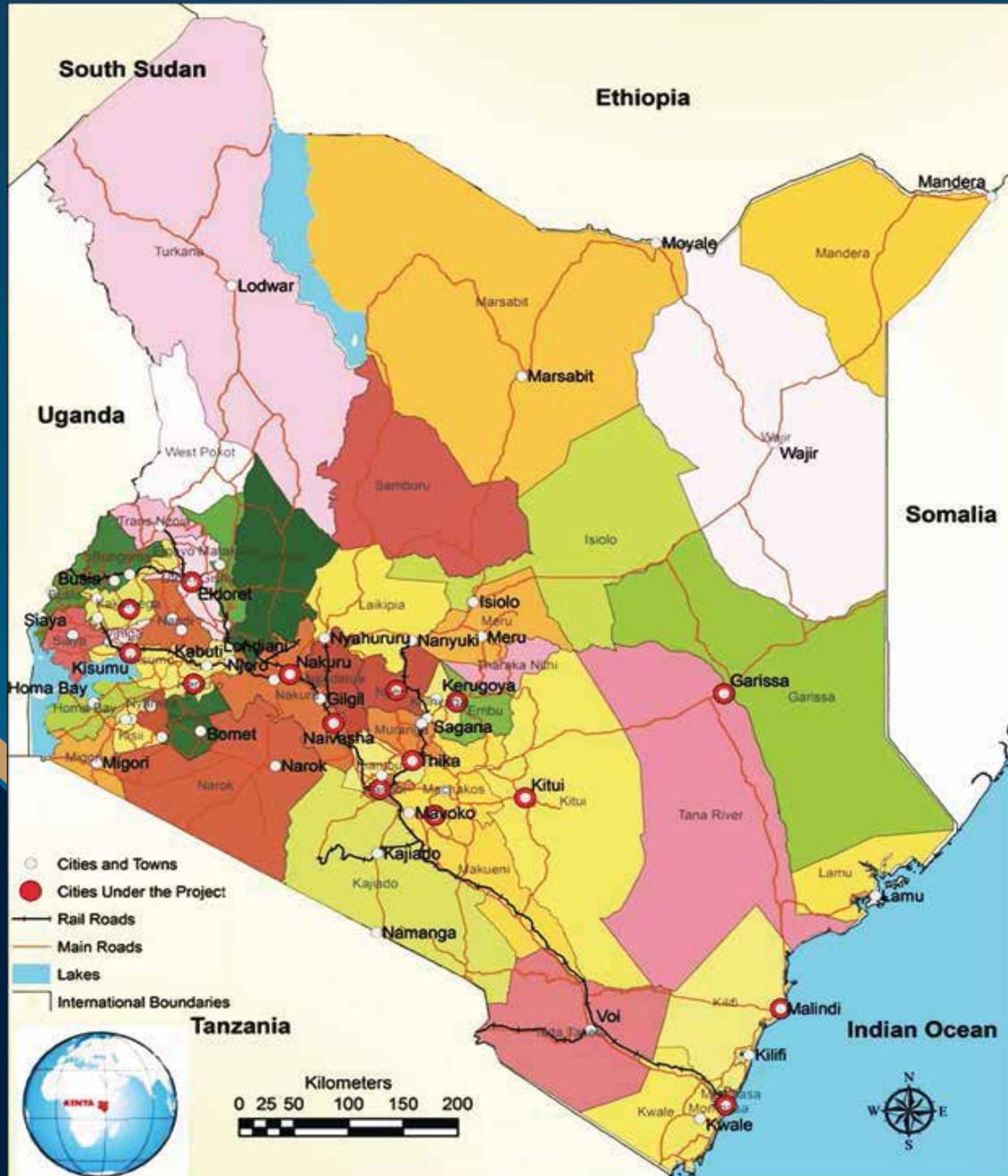


# Kenya STATE OF THE CITIES



## MACHAKOS





# KENYA STATE OF THE CITIES BASELINE SURVEY

STATISTICAL ABSTRACT FOR MACHAKOS, KENYA



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# ABBREVIATIONS

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<b>CAPI</b>	Computer Assisted Personal Interview
<b>EA</b>	Enumeration Area
<b>GOK</b>	Government of Kenya
<b>HH</b>	Household
<b>HUD</b>	U.S. Department of Housing and Urban Development
<b>KIHBS</b>	Kenya Integrated Household Budget Survey
<b>KISIP</b>	Kenya Informal Settlements Improvement Program
<b>KMP</b>	Kenya Municipal Program
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>NMSP</b>	Nairobi Municipal Service Project
<b>PDA</b>	Personal digital assistant, in this case a hand held computer used by interviewers
<b>PSU</b>	Primary Sampling Unit
<b>SMSA</b>	Standard Metropolitan Statistical Area
<b>SRS</b>	Simple Random Sample
<b>SSU</b>	Secondary Sampling Unit
<b>WB</b>	World Bank
<b>WBG</b>	World Bank Group



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# INTRODUCTION

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## Background

The Kenyan government, with the support of development partners, is increasing its investments in urban infrastructure and services. To support these efforts, the World Bank has contracted NORC at the University of Chicago to carry out a baseline study of the demographic, infrastructure, and economic profiles of fifteen Kenyan towns and cities: Nairobi City, Mombasa, Naivasha, Nakuru, Malindi, Eldoret, Garissa, Embu, Kitui, Kericho, Thika, Kakamega, Kisumu, Machakos, and Nyeri. This was undertaken in order to deepen understanding of the cities' growth dynamics, and to identify specific challenges to quality of life for residents. The study, called the "Kenya State of the Cities Baseline Survey," collects and analyzes household survey data to produce key statistics and identify differences in conditions among types of households—especially differences between those living in informal versus formal settlements. The ultimate goal is to use the information to establish development priorities for infrastructure and service investments and, eventually, to track the effectiveness of these investments.

Prior to the State of the Cities survey, there were little data available to support the design of programs to improve infrastructure and related services in most Kenyan cities. While there have been several household surveys of Nairobi's informal settlements and numerous analyses using the data, few surveys or analyses have been carried out in other Kenyan towns and cities or for modest-income areas in Nairobi.

To facilitate access to the rich datasets generated by the survey, three written products were commissioned: a Statistical Abstract (such as this one) for each city, a City-at-a-Glance for each city (a two-to-three-page summary of the Abstract), and an Overview Report (a more comprehensive discussion of the topics in this Introduction, a topic-by-topic comparative analysis of the fifteen cities, and appendices with the survey instrument). The Abstract's objective is to provide comprehensive but easily accessible information on the wide range of municipal conditions covered in the survey, as reported by households. Some information in the Abstract also comes from secondary sources, such as the national Census and the Kenya Integrated Household Budget Survey (KIHBS). The primary audience for the Abstract includes policy makers, development practitioners, development partners, civil society organizations, and urban residents. Better planning and more productive investments can result from exploiting the information in each city's Abstract.

## Methodology

For this baseline household survey, NORC used a two- and three-stage, stratified, cluster sampling design intended to be representative of poor and non-poor households living in formal and informal settlements in the fifteen cities included in the study. The first-stage sampling frame was based on Kenya's 2009 census frame of enumeration areas (EAs). In the census sample frame, EAs are identified as urban, peri-urban or rural. EAs are further identified as containing formal or informal settlement types. For the first stage sampling, NORC selected EAs from strata identified as informal (slum), urban-formal, peri-urban-formal and rural. In cases where the EAs were "large" (200 to 700 households) these EAs were divided in half, thirds, or quarters and one segment was randomly selected.

For the final stage of sampling, NORC carried out a full household listing in each selected EA (or segment, as the case may be) and randomly selected ten households for interviewing. Because expected response rates were unknown prior to data collection, interviewers were given a target to complete at least seven interviews in each EA. In Machakos, 121 EAs were selected in the first stage. In the second stage, a total of 7,421 households were listed and 1,202 households were selected.

The data for this report are based on 763 completed interviews carried out in Machakos from November 12, 2012 to February 28, 2013 by a team of five interviewers and one supervisor. Among eligible households, the completion rate was 55.99 percent. Data collection took place in both formal and informal settlements simultaneously; 148 interviews were completed in informal settlements and 525 were completed in formal settlements.

## Questionnaire

The Kenya State of the Cities baseline questionnaire was developed iteratively using a base set of questions developed by the World Bank and refined to capture the key variables related to infrastructure access and municipal services of interest to the Kenyan government. The final fielded questionnaire is available in Volume II of the Overview Report. Both the household listing form and the questionnaire were programmed for use as a Computer-Assisted Personal Interview (CAPI) and both were carried out using tablet computers which transmitted data to project servers via the mobile phone network. Interviewers captured GPS coordinates during listing and again at the end of each interview.

## Data Quality

Recorded administration time of the CAPI instrument showed a median duration of 21 minutes in Machakos (also 21 minutes across all towns and cities). However, duration values may have been compromised by transmission problems and supervisor reviews, which may have overwritten timestamps. Despite the uncertainty of exact durations, data quality measures do not show systematic interviewer-related errors in the final data. Approximately a third of all interviews underwent validation, including call-backs by supervisors or central office staff (in-person and by phone).

## Table Presentation

Each city's Abstract includes a set of tables designed to provide basic information on households' economic and demographic conditions, their housing conditions, and access to infrastructure and services. One challenge in preparing the Abstract was to provide a complete picture of conditions while still being selective in the information presented so as not to overwhelm the reader. A second challenge was to display the information in a way that permits stakeholders to understand conditions faced by different population groups.

To meet these challenges we have developed a set of tables with items believed to be most important for stakeholders and have broken down the items in several ways. In addition to providing an overall picture of household (HH) characteristics, the tables illustrate whether household characteristics differ by key factors. The rows of each table generally list the household characteristics (e.g., size of household, percentage of children in school). The columns present statistics for the entire city, then

show how the data differs by location (informal vs. formal areas), household poverty status (poor vs. non-poor), gender of the head of household (male vs. female headed, for informal areas only), as well as other factors pertinent to the particular table.<sup>1</sup>

From each table, one can quickly observe if there are large differences in household characteristics by location, spending power, etc., simply by comparing the cells (numbers). Each table also shows whether the observed differences are statistically significant.<sup>2</sup> “Statistically significant” means that statistical analysis has revealed that a difference, no matter how small or large, is unlikely due to chance or randomness. In practice, statistically significant differences are the ones researchers are interested in—they can be interpreted as telling us about meaningful differences in household characteristics by location, spending power, gender, or other category. When we discuss differences in the text of this report, we will refer to “statistically significant” differences unless otherwise noted.

In terms of policy decisions, whether differences matter is a combination of whether they are statistically significant *and* how large the differences are. Ultimately, it is up to the policy practitioner to decide how large a difference must be to matter in the context of interest. An important note when interpreting results is that statistical significance does not imply causality. In other words, if differences in values are statistically significant, this does not mean that one variable caused a change in the other variable. Another factor may be influencing both variables; for example, for we may find a “significant” difference between head-of-household education and household poverty, perhaps the key *common* cause is social status, which affects both their educational attainment and job/spending opportunities. Additionally, where a statistically significant difference is identified it does not imply the direction of the relationship. Perhaps the household poverty is the reason for the different education levels, or vice-versa. In this report, therefore, we will say a household characteristic is “associated with” or “correlated” with certain factors, rather than saying one is caused by another.

In order not to clutter the tables yet provide the reader with the maximum information, we mark statistically significant results in the tables with **bold** (for two adjacent values in the same row) and *italics* (to compare adjacent columns of data). Underlined values denote an insufficient number of household responses for some enumeration category of the sampling design to perform a test of statistical significance. The number of observations for a particular variable is noted in the tables in rows denoted by “N”. Cells with no observations are indicated with hyphens (-).<sup>3</sup> The table, below, summarizes the formatting used in tables throughout the Abstract: A value that is both **bold** and *italicized* indicates statistically significant differences for two adjacent cells (i.e., values in the same row) as well as for the distributions between adjacent columns. In contrast, a value in standard font—no bolding, italics, or underlining—still means that a significance test *was* performed but that the values under comparison were not statistically significantly different from each other.

---

<sup>1</sup> Informal/formal status was defined at the enumeration area level by the Kenya National Bureau of Statistics during the 2009 Census. Poor/non-poor is defined using the answer to a question asking respondents whether their total household expenditure in the last month was above or below a poverty line calculated using the household size (5,567 KSh for each adult 15 years and older + 3,619 KSh for each child aged 5 to 14 + 1,336 KSh for each child under 5 years old).

<sup>2</sup> Statistical significance is noted when a test achieves a  $p$ -value  $\leq 0.05$ .

<sup>3</sup> Regarding issues of non-response, both observational and item-specific, see Section 4, below.

There is one caveat to the formatting rules that must be addressed regarding the significance testing of distributions. While the absence of italics sometimes means that the distribution *was* tested and *was not* found to be statistically significant, this is often not the case—i.e., there are many distributions which were not tested for significance. To avoid confusion, the comprehensive list of distributions which *were* tested for significance follow.

- **Table B.2a:** Expenditure ranges by location, tenure, water connection, business, skilled/unskilled head, and gender of household head (in informal areas)
- **Table B.2b:** Income ranges by location, tenure, water connection, business, skilled/unskilled head, and gender of household head (in informal areas)
- **Table C.3:** Distribution of home value ranges and rent ranges by location, tenure, water connection, business, skilled/unskilled head, and gender of household head (in informal areas)
- **Table D.1a:** Percent of households with a piped water connection inside their dwelling by security of ownership; percent of households with a piped water connection inside their compound by security of ownership; percent of households close to piped water access by security of ownership; cost of water by security of ownership; most important water source by security of ownership; reasons for no connection by security of ownership
- **Table D1.b:** Water source by water quality; water provider by water quality; water treatment buy water quality; treatment methods by water quality.

**Table 1: Description of formats used to denote statistical significance**

Format	When we use it	Example
<b>Bold</b>	Two bolded values in the same row next to each other indicate that the difference is statistically significant.  We also use bold for ‘Yes’ or ‘No’ variables. If bold, it means that the difference between the mean of households that answered ‘yes’ (displayed) and the mean of those that answered ‘no’ (not displayed) is statistically significant. <sup>(a)</sup>	Table A.1 displays the mean household size for households located in formal and informal settlements; if the pair of values is bold, it means that the difference in household sizes between formal and informal areas is statistically significant.  Table B.2 displays the proportion of households which own land (or have tenure) that fall below the poverty line. If bold, it means that this proportion is statistically significantly different from the proportion of households which do not own land that fall below the poverty line.
<i>Italics</i>	We indicate statistically significant differences between columns of <i>three or more cells</i> using italics; this means the difference between the entire distributions (columns) is statistically significant. <sup>(b)</sup>	Table B.2, Monthly household spending power, displays the distribution of households across income and expense ranges. If values appear italicized in both columns for households located in formal and informal settlements, the difference between the two distributions is statistically significant.
<u>Underline</u>	Denotes values where, due to lack of data at the census tract (enumeration area, or EA) level, it was not statistically possible to conduct the significance test. <sup>(c)</sup>	Table B.3 shows the mean value of households’ primary residence with and without land, and of any other residence and/or land. An underlined value means that due to lack of data at the census tract level, it is not possible to perform a test for significant differences.
Hyphen (-)	In cases where there are no data for a cell at all, we note that with a hyphen (-).	Table B.3 shows data related to household finance. For the percentages of households according to source of financing, the cells that display a hyphen means that there were no observations for that particular variable and category.

Notes:

- Here a *p*-test from an Adjusted Wald test is conducted.
- Here Pearson’s Chi-squared test is conducted.
- At least two households are required to compute a household-level variance, which is required to conduct a hypothesis test. Note that this does not imply that the respective table values are based on just one household or even just one EA.

Another feature of the data worth mentioning is that outliers (responses that are very different from all the others) were not a major issue in the survey data, affecting just three variables in any important way.<sup>4</sup>

Finally, note that in tables presenting a distribution of responses, if some response categories are left out then the distribution will not add up to 100%. In cases where all response categories *are* listed then the first row of responses is given as 100. Unless otherwise noted, all figures presented in the tables are percentages.

The core of this abstract comprises a set of tables divided into chapters. Each chapter contains a textual summary of each table and highlights some of their implications. The tables are divided into four groups:

- A. Household characteristics – 3 tables
- B. Economic profile – 5 tables
- C. Tenure, tenure security, dwelling characteristics – 4 tables
- D. Infrastructure services – 7 tables

Notes to the tables are identified by small letters appearing as superscripts at the end of each table. All tables present weighted figures at the household level, unless otherwise noted, to reflect the total population of the respective table cell. The N values, however, present the *unweighted* number of households, unless otherwise noted.

The final chapter of this abstract contains a series of three “Development Polygons”. These complement the detailed tables presented in sections A through D by illustrating an “overall” sense of the state of the city. The figures included are the Development Diamond, the Infrastructure Polygon, and the Living Conditions Diamond.<sup>5</sup>

While the tables generally have a common set of column headings, there is some variation. The following are definitions for those headings that require clarification:

- *Informal/Formal Areas* – This distinguishes between areas based on whether most households in the area have property title and official services. It is a designation provided by a status code at the level of the EA (Enumeration area) as used by the National Census.
- *Gender (Informal)* – For the households living in the locations coded as “Informal,” data for household characteristics are provided for both male- and female-headed households. As is standard, the male-headed households may contain the spouse while female-headed households do not.
- *Class (of durable)* – Durable assets are a standard measure of household wealth. They are grouped into three classes, roughly based on their likely market value and degree of permanence. The actual items in each class are indicated in the table. The values reported for these categories are the number owned by the household, not their average or total value.

<sup>4</sup> Across *all* fifteen municipalities these were (i) home value, in which 20 responses were reported in millions units instead of as the value itself (so we simply divided these responses by a million); (ii) 40 respondents reported travel time for a weekly or monthly commute rather than a daily commute (these over-eight-hours responses were dropped); (iii) we removed one case in which the time to get water was over a week.

<sup>5</sup> The basic format for all three figures appear in the World Bank Policy Research Working Paper, “*Poverty, Living Conditions, and Infrastructure Access*” A Comparison of Slums in Dakar, Johannesburg, and Nairobi” by Sumila Gulyani, Debabrata Talukdar, and Darby Jack (2010). We strived to make our own figures as similar as possible, though some deviations, noted in the accompanying text, were necessary.

- *Spending Power* – The total value of household expenditures collected by the survey, excluding rent or mortgage payments.
- *Access to Infrastructure* – This indicator combines six categories of infrastructure (divided into 13 subcategories) weighted by importance to the household and summed to create a household indicator from 0 to 9.5. See NORC (August 2013), “Kenya Municipal Program State of the Cities: Overview Report” for a more detailed description.
- *Household Poverty* – The poverty line varies depending on the number of members of the household and their age. It is calculated by adding together:
  - 5,567 KSh per month for each adult 15 years and older in household,
  - 3,619 KSh per month for each child aged 5 to 14 in household,
  - 1,336 KSh per month for each child under 5 years old in household.



## HOUSEHOLD CHARACTERISTICS

This section presents basic household characteristics. Table A.1 provides information on household size and household member distribution by age category. Table A.2 details the level of education of the members of household, as well as the proportion of children and adults of different ages who were currently in school at the time of the survey. Finally Table A.3 presents household health characteristics, including the proportion of children under 15 who have received the BCG vaccine (an immunization against tuberculosis), a major public health concern given that Kenya is a high-tuberculosis-burden country.<sup>6</sup> Table A.3 also includes the number of household members with an illness or injury in the two weeks prior to the survey, the proportion of those members who visited a health practitioner, average household medical expenditures for the month preceding the survey, and the percentage of households that have health insurance. All of these figures are given comprehensively and broken down by location type, the household's poverty status, and the gender of head of household (among informal areas).

### A.1 Household Demographic Composition

The 2009 census estimated that the municipality of Machakos had a population of 150,041, a 5% increase over the figure reported in the 1999 census; this represents of a 0.46% annualized average growth rate.<sup>7</sup>

The average household size in Machakos, as reported by survey respondents, is 3.1 members. On average, about 87% of households' members are aged 5 to 60 years old—14.1% are between 5 and 14 years old, while 73% are between 15 and 60—with about 8.8% are under 5 and 4% are over 60. The mean percentage of children under 5 is significantly higher in informal areas (12.3%) than formal areas (8.6%), while the mean percentage of children 5 to 14 is significantly higher in formal areas (14.4% vs. 9.8%) and the mean percentage of seniors (+60) is significantly higher in poor areas than in non-poor areas (5.1% vs. 2.1%). The head of household is female in 28% of all households. Thirty-seven percent of non-poor households are headed by females, whereas 23% of the poor ones have female heads, i.e. given their household size they have monthly expenditures below the poverty line—these differences are significant.

<sup>6</sup> World Health Organization Global tuberculosis report 2012, retrieved June 12th 2013 from [http://www.who.int/tb/publications/global\\_report/en/](http://www.who.int/tb/publications/global_report/en/)

<sup>7</sup> From Statistical Abstract 2010 and Statistical Abstract 2006, Kenya National Bureau of Statistics.

**Table A.1: Household demographic characteristics**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Number of households							
Weighted	24,091	1,431	22,660	15,093	8,974	1,052	369
N (unweighted)	670	148	522	420	249	107	40
Size of household	3.13	2.82	3.15	3.19	3.03	3.01	2.29
N	670	148	522	420	249	107	40
Mean percent of household members aged:							
Total	100	100	100	100	100	100	100
Under 5	8.8	12.3	8.6	9.3	7.8	13.4	9.5
5 to 14	14.1	9.8	14.4	14.9	12.8	8.8	12.8
15 to 60	73.0	72.4	73.0	70.6	77.0	72.6	71.0
Over 60	4.0	4.9	4.0	5.1	2.1	4.6	5.8
N	670	148	522	420	249	107	40
Proportion of households...							
Male-headed	72	74	72	77	63		
Female-headed	28	26	28	23	37		
N	657	147	510	412	244		
Female-headed distribution		5	95	51	49		
N		180	179				

## A.2 Household Education Characteristics

Machakos was part of the Eastern Province, where in 2009 primary classrooms had an average class size of 32 students and secondary classrooms had on average 33 students. Student-teacher ratios in the former Eastern Province were, on average, 40.3 for primary schools and 33 for secondary schools.<sup>8</sup>

The first panel of Table A.2 presents statistics on the education of *all individuals aged 5 years and older* within the surveyed households. About 38% of all individuals have completed secondary school or higher—a figure that is likely skewed by the fact that the majority of household members are between 15 and 60 years old—and 69% completed primary or higher. A significantly higher percentage of household members in formal areas had some primary school than did so in informal areas; on the other hand, significantly fewer household members in formal areas completed secondary education (22% vs. 29% for informal areas). School grade attainment registers statistically significant differences by poverty level; whereas a considerably larger proportion of individuals from poor households registered some primary or completed primary than those from non-poor household (60% vs. 35%), individuals from non-poor households were considerably more likely to pursue higher education than those from poor households (31% vs. 8%). Having no education is rare; only 1% of individuals had no education and there are practically no individuals in both poor and non-poor households that received no education.

<sup>8</sup> Provinces no longer exist in Kenya. This data is based on the Kenyan Institute for Public Policy Research and Analysis 2009 Economic Report, Table A3.16, pg. 192, per Ministry of Education statistics, [http://www.marsgroupkenya.org/pdfs/2009/10/Kenya\\_Economic\\_Report\\_2009.pdf](http://www.marsgroupkenya.org/pdfs/2009/10/Kenya_Economic_Report_2009.pdf) Section

The second panel of the table shows the mean percent of *adult individuals over 18 years* within each household. This is done to show intra-household educational levels among households' adult members. We find that on average, 50% of a Machakos household's adults have completed secondary school or higher (29.2% completed secondary, while 20.8% completed higher education). Only about 1.6% of a household's adults had no education whatsoever. The remaining 48% completed some primary, all of primary, or some secondary schooling. We also found interesting differences between poor and non-poor households. Among poor households, a significantly higher percentage of adults completed no education, some primary, or all of primary school, while a significantly lower percentage completed higher education past secondary. Finally, we did not find significant differences in school attainment between male- and female headed households' adults in informal areas.

Almost 97% of individuals aged 5 to 14 years old are currently in school; this figure is 67.3% for individuals 15 to 18 and 7% for individuals over 18. The percentage of individuals over 18 that are currently in school is significantly higher among non-poor households than among poor ones (10.8% vs. 4.7%).

**Table A.2: Household education characteristics**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of <i>individuals 5 and older</i> with highest grade completed:							
Total	100	100	100	100	100	100	100
None	1	2	1	1	1	1	3
Some Primary	29	<b>22</b>	<b>30</b>	<b>34</b>	<b>21</b>	23	20
Completed primary	22	27	21	<b>26</b>	<b>14</b>	27	24
Some secondary	9	6	9	10	8	6	6
Completed secondary	22	<b>29</b>	<b>22</b>	21	26	29	28
Higher	16	15	16	<b>8</b>	<b>31</b>	14	20
N	1,760	349	1,411	1115	643	270	77
Mean percent of household's <u>adults over 18</u> with highest grade completed:							
Total	100	100	100	100	100	100	100
None	1.6	2.2	1.5	<b>2.4</b>	<b>0.2</b>	1.5	4.4
Some Primary	12.4	10.4	12.5	<b>16.7</b>	<b>5.1</b>	12.0	6.3
Completed primary	27.0	31.5	26.7	<b>32.9</b>	<b>17.2</b>	32.7	26.4
Some secondary	8.6	<b>3.5</b>	<b>8.9</b>	9.6	7.0	3.0	5.1
Completed secondary	29.2	31.7	29.0	27.3	32.4	32.1	31.4
Higher	20.8	19.9	20.8	<b>10.9</b>	<b>37.4</b>	18.3	25.2
N	670	148	522	420	249	107	40
Percent of <u>individuals in school</u> by age group:							
5 to 14	96.8	<u>100.0</u>	<u>96.6</u>	<u>96.9</u>	<u>96.6</u>	<u>100.0</u>	<u>100.0</u>
N	236	41	195	154	82	28	13
15 to 18	67.3	<u>72.4</u>	<u>67.1</u>	<u>73.2</u>	<u>57.7</u>	<u>82.5</u>	<u>67.5</u>
N	92	16	76	53	39	9	6
Over 18	7.0	7.4	6.9	4.7	10.8	8.3	5.1
N	670	148	522	420	249	107	40

### A.3 Household Health Profile

Machakos was part of Eastern Province, which in 2005 had an average of 9 doctors and clinical officers per 100,000 residents and 49 nurses per 100,000 residents.<sup>9</sup> The former Eastern Province had about 11 medical facilities per 100,000 residents, including hospitals, clinics, dispensaries, and other types of facilities.<sup>10</sup>

Overall, 98% of households' report their children under 15 have received BCG (tuberculosis) immunizations, with not enough observations within enumeration areas to test statistical significant of variation between groups. Fifteen percent of households had a sick or injured household member in the two weeks prior to the interview. Seventy-three percent of these visited a health practitioner. Rates of health insurance coverage are quite low (25%), and vary significantly by poverty level (48% among non-poor households vs. 11% among non-poor households).

**Table A.3: Household health characteristics**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of household's children under 15 having received BCG immunization	98	97	98	98	98	98	93
N	356	81	275	231	124	60	21
Percent of households with an injured/ill member, previous two weeks	15	12	15	15	15	12	14
N	670	148	522	420	249	107	40
Percent of ill household members that visit a health practitioner, previous two weeks	73	40	74	75	68	35	52
N	85	17	68	44	41	12	5
Household medical expenditures (KSh), previous month	418	317	425	281	655	301	370
N	662	146	516	418	244	105	40
Percent of households with health insurance	25	20	25	11	48	20	22
N	670	148	522	420	249	107	40

<sup>9</sup> 2004/2005 numbers of healthcare providers obtained from Partners for Health Reformplus 2006 Report, Table A1, pg. 39, Annex A, statistics obtained from Rep. of Kenya. [www.healthsystems2020.org/files/1654\\_file\\_Tech101\\_fin.pdf](http://www.healthsystems2020.org/files/1654_file_Tech101_fin.pdf). Per capita figures calculated by dividing by 2005 (estimated) population obtained from the Kenya Integrated Household Budget Survey, Table 3.1, [http://www.knbs.or.ke/pdf/Basic%20Report%20\(Revised%20Edition\).pdf](http://www.knbs.or.ke/pdf/Basic%20Report%20(Revised%20Edition).pdf).

<sup>10</sup> Based on most current (undated) figures from Kenya Bureau of Statistics Open Kenya online database, <https://kenya.socrata.com/Health-Sector/Health-Facility-Pie-Chart/yr4-763w>. Per capita figures calculated by dividing by 2009 census population, obtained from 2010 Statistical Abstract, Kenya National Bureau of Statistics.

### B.1 Household Occupational Composition

Table B.1 presents the current occupation, or main activity, of household members. The first panel shows the percent of all adults over 18 in each of the occupations. The five most prominent occupation categories are casual employee, regular employee, homemaker, self-employed and student, which together comprise almost 80% of all adults in Machakos over 18 years old. However, the unemployment rate is high, affecting 10% of adults, same that are looking for jobs. Individuals in formal areas are significantly more likely to invest and gain rents from such investments. Most significant differences in the composition of adults' occupation among households are determined by poverty level. Whereas a larger proportion of poor households tend to be composed by members that spend most of their time as homemakers (25.9%, vs. 7.3% of non-poor households), more individuals from non-poor households are regular employees and students. Interestingly, a considerably larger proportion of members from non-poor households are unemployed and looking for a job than those from poor households; however, a possible reason could be that the unemployment has deeper impacts on non-poor households than on the poor ones because a larger proportion of non-poor individuals work outside the household and therefore look for jobs if unemployed, in contrast to individuals in poor areas who do not look for jobs outside the household, instead working inside the household as homemakers or other activities. Regarding the gender of the household head, the only significant difference between both types of households is the larger proportion of homemakers in male-headed households (24.5%, vs. 7.6% in female-headed households).

The second panel shows the average percent of adults over 18 *within each household* that are occupied in each of the categories. This is done to show intra-household occupational status among households' adult members. The results here are similar to those in the first panel above. Here, we find that on average, about two-thirds (66.3%) of a household's adult members are either regular employees, casual employees, or self-employed. About 11% are homemakers, 7% are students, and 7.6% are unemployed but looking for work; no other category includes more than 2.5% of adult household members. Our survey found that poor households contain, on average, a significantly higher percentage of adults who are casual employees and homemakers, and a significantly lower proportion of regular employees and students. Although statistically significant, the difference in the proportion of pensioners/investors between poor and non-poor households is subtle. In informal areas, male-headed households contain significantly higher average percentages of adults who are regular employees (14.8% vs. 5.1% of female-headed household members), casual employees (31.1% vs. 18.9% of female-headed household members), and students (5.1% vs. 3.3%). Male-headed households also hold a larger proportion of homemakers, though the difference is small (15.7% vs. 13.2%).

**Table B.1: Household members' main activity**

Occupation <sup>a</sup>	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of <i>adults over 18</i> with occupation:							
Employer	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regular employee	13.8	13.4	13.8	<b>9.2</b>	<b>21.5</b>	12.5	16.6
Casual employee	33.9	38.8	33.6	36.0	30.4	37.9	40.9
Self-employed	7.0	4.9	7.1	6.5	7.9	3.7	9.2
Unpaid family worker	0.1	0.3	0.1	0.1	0.0	0.0	1.3
Apprentice	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Student	6.0	6.8	5.9	<b>3.8</b>	<b>9.6</b>	6.2	8.8
Pensioner/investor	3.1	1.9	3.2	3.8	2.1	2.4	0.0
Earning from investments/ property	2.1	<b>0.3</b>	<b>2.2</b>	1.9	2.4	0.4	0.0
Sick/unable to work	0.1	0.0	0.1	0.2	0.0	<u>0.0</u>	<u>0.0</u>
Unemployed looking for work	10.1	8.3	10.2	<b>7.7</b>	<b>13.9</b>	7.7	11.0
Unemployed, not looking for work now	4.6	4.6	4.6	4.5	5.0	4.7	4.4
Homemaker	18.9	20.7	18.8	<b>25.9</b>	<b>7.3</b>	<b>24.5</b>	<b>7.6</b>
N	1,341	280	1,061	834	505	217	62
Mean percent of household's <i>adults over 18</i> with occupation: <sup>b</sup>							
Employer	2.1	<u>0.6</u>	<u>2.7</u>	<u>0.9</u>	<u>4.7</u>	<u>0.8</u>	<u>0.1</u>
Regular employee	21.0	12.5	24.4	<b>19.3</b>	<b>24.7</b>	<b>14.8</b>	<b>5.1</b>
Casual employee	25.3	28.2	24.0	<b>28.2</b>	<b>18.9</b>	<b>31.1</b>	<b>18.9</b>
Self-employed	20.0	22.3	19.1	19.3	21.8	15.8	44.7
Unpaid family worker	2.5	2.7	2.5	2.7	2.7	3.5	0.0
Apprentice	0.2	<u>0.1</u>	<u>0.2</u>	<u>0.2</u>	<u>0.1</u>	<u>0.0</u>	<u>0.0</u>
Student	7.0	4.8	7.9	<b>6.5</b>	<b>7.7</b>	<b>5.1</b>	<b>3.3</b>
Pensioner/investor	0.4	0.7	0.3	<b>0.4</b>	<b>0.3</b>	0.8	0.2
Earning from investments/ property	0.2	0.2	0.1	0.1	0.3	0.2	0.0
Sick/unable to work	0.1	0.2	0.1	0.1	0.2	<u>0.3</u>	<u>0.0</u>
Unemployed looking for work	7.6	9.2	7.0	7.5	8.1	8.8	10.7
Unemployed, not looking for work now	1.4	2.1	1.2	1.3	1.7	2.0	2.2
Homemaker	10.7	15.4	8.7	<b>11.7</b>	<b>8.3</b>	<b>15.7</b>	<b>13.2</b>
N	972	490	482	660	308	380	108

Notes:

- The category "Other" has been omitted.
- These numbers are obtained by first computing the percentages of each household's members in each category, and then taking the mean of these percentages over all households.

## B.2 Household Income/Expenditure Levels

There are two general approaches to measure spending power: expenditure and income, both of which are shown in the tables below. In the survey, income derives from household members' salaries, business earnings, rents, public cash support, and earnings from financial assets in the month prior to the interview, but does not include any remittances. Expenditures include all purchases, including

investments for household-owned businesses. In theory, both approaches express the same amount of spending power, but typically one approach is not enough, especially when estimations are based on survey data. This is because survey respondents' perceptions about their income and expenditures can be unreliable; estimates vary depending on seasonal changes in economic activities, type of assets owned, household's cash flows, and in-kind payments.

In practice, the expenditure approach is usually more accurate because most respondents, making purchases daily, recall their expenses better. Income, on the one hand, can be problematic because it can be subject to respondent misreporting (e.g., desire to impress the enumerator) and, with non-wage income; respondents do not generally make a clear distinction between revenue (sales) and income (revenue minus expenses). Using both methods, therefore, provides an additional level of verification.

Over half (63%) of all households have monthly expenditures below the poverty line, as determined by the household composition. This proportion is considerably higher among households with land tenure (79%), whereas only 13% of households with water connection are poor. Similarly, considerably fewer households whose heads are considered skilled are below the poverty line than those whose heads are unskilled (51% vs. 67% respectively).

Income and expenditure distributions vary significantly depending on tenure status, water connection, business ownership, and whether the household head is skilled or unskilled. Whether a household owns a water connection is a particularly strong predictor of income and expenditure levels—households with a water connection are more likely to fall into the highest income/expenditure categories and significantly less likely to be below the poverty line.

On average, households who sent money to individuals outside their household sent around 5,824 KSh in the three months prior to the interview, and those that received money received, on average, almost 6,698 KSh in the same period. Households were more likely to send money than to receive it, and wealthier households were much more likely to send money—67% of households in the top expenditure category sent money to friends or relatives, compared to 17% of those in the bottom. However, there are no large differences in the proportion of households receiving remittances (transferred income) across income categories (14-19%), except for the two bottom income categories—less than 3,000 KSh and 3,001 to 6,000 KSh, in which 42% and 32% of households are remittance recipients, respectively.

**Table B.2a: Monthly household spending power, as measured by expenditure**

Characteristic	All	Location		Household has...		Household head is <sup>c</sup>			Gender (Informal)		Value of transfer (row pct.) <sup>d</sup>
		Informal areas	Formal areas	Tenure <sup>a</sup>	Water connection	A business <sup>b</sup>	Skilled	Unskilled	Male-headed	Female-headed	
Percent of households below poverty line	63	53	63	<b>79</b>	<b>13</b>	53	<b>51</b>	<b>67</b>	55	47	
N	669	148	521	193	44	62	184	485	107	40	
Mean expenditure (monthly KSh)	16,260	13,749	16,419	14,360	<b>50,875</b>	23,357	<b>22,378</b>	<b>13,938</b>	14,272	12,372	
N	670	148	522	193	44	62	184	486	107	40	
Percent of households with expenditure: <sup>d</sup>											
Less than 3,000 KSh	4	0	4	<b>8</b>	0	3	1	<b>6</b>	<u>0</u>	<u>0</u>	3,145 (17%)
3,001-6,000 KSh	14	15	14	<b>22</b>	0	3	<b>5</b>	<b>18</b>	14	17	2,022 (18%)
6,001-9,000 KSh	18	23	18	16	<b>2</b>	12	<b>11</b>	<b>21</b>	24	19	3,144 (21%)
9,001-30,000 KSh	21	24	21	22	<b>4</b>	14	24	20	21	30	2,978 (39%)
13,001-18,000 KSh	18	17	18	<b>10</b>	9	<b>38</b>	18	17	18	14	3,924 (41%)
18,001-30,000 KSh	14	16	14	11	32	17	<b>22</b>	<b>11</b>	14	19	5,367 (59%)
31,001-75,000 KSh	8	7	9	9	35	8	<b>16</b>	<b>5</b>	9	0	11,350 (63%)
Above 75,000 KSh	2	0	2	1	<b>17</b>	<b>7</b>	3	1	0	0	23,079 (67%)
N	670	148	522	193	44	62	184	486	107	40	247
Cash transfers <sup>e</sup>	5,827	<u>4,396</u>	<u>5,888</u>	<u>11,933</u>	<u>20,000</u>	<u>7,815</u>	<u>4,012</u>	<u>7,244</u>	<u>3,857</u>	<u>5,217</u>	
N	125	24	101	43	4	14	31	94	16	8	

Notes:

- Household possesses deed or other officially recognized document conferring ownership of the structure, land, or both.
- "Business" refers to a self-employed activity that may or may not entail household or wage employees.
- Includes those self-declared as "skilled" as well as "professional".
- An imputed 30-day value from responses over several periods (7 days for food, 30 days for other consumables, 12 months for durables and annual services). See Volume I in the Overview Report. No significance test performed on this column.
- Transfers are cash outflows over last three months averaged over households with such flows (equal to proportion of row households in parentheses).

**Table B.2b: Monthly household spending power, as measured by income**

Characteristic	All	Location		Household has...			Household head is <sup>c</sup>		Gender (Informal)		Value of remittance (row pct.) <sup>d</sup>
		Informal areas	Formal areas	Tenure <sup>a</sup>	Water connection	A business <sup>b</sup>	Skilled	Unskilled	Male-headed	Female-headed	
Proportion of households with income: <sup>d</sup>											
Less than 3,000 KSh	3	0	3	8	0	0	1	4	0	0	2,598 (42%)
3,001-6,000 KSh	10	9	10	17	0	1	6	11	8	13	6,100 (32%)
6,001-9,000 KSh	18	24	18	20	1	6	9	22	25	23	5,251 (14%)
9,001-30,000 KSh	14	17	14	12	1	9	12	15	17	16	6,077 (19%)
13,001-18,000 KSh	18	14	18	16	2	26	16	18	12	21	7,105 (19%)
18,001-30,000 KSh	22	22	22	17	13	36	26	20	25	15	5,502 (15%)
31,001-75,000 KSh	13	13	13	8	57	20	24	9	14	12	24,976 (6%)
Above 75,000 KSh	2	0	2	2	26	3	6	1	0	0	10,000 (18%)
N	658	144	514	189	44	62	182	476	105	38	114
Cash remittances <sup>e</sup>	6,698	<u>7,862</u>	<u>6,638</u>	<u>7,406</u>	<u>11,204</u>	<u>11,351</u>	<u>7,315</u>	<u>6,511</u>	<u>8,077</u>	<u>7,427</u>	
N	125	24	101	43	4	14	31	94	16	8	

- Notes:
- Household possesses deed or other officially recognized document conferring ownership of the structure, land, or both.
  - "Business" refers to a self-employed activity that may or may not entail household or wage employees.
  - Includes those self-declared as "skilled" as well as "professional".
  - Total household cash income in KSh, previous month, not including in-kind income or cash assistance from/to family or friends who live outside the household. No significance test performed on this column.
  - Remittances are cash inflows over last three months averaged over households with such flows (equal to proportion of row households in parentheses).

### B.3 Household Wealth Composition

The "household wealth index" is calculated from the household's declared ownership of a list of common household items. The value itself is created by totaling the estimated value of each item (indicated in brackets, in USD), converting to KSh, and dividing by 1,000; so the average of 32.7 means that the average household owned approximately 32,700 KSh worth of listed possessions. However, since each possible possession was only counted once, this should not be taken as a reliable estimate, but rather a unitless index of comparison.

This value is significantly higher in formal than informal areas, non-poor vs. poor households, and male- vs. female-headed households (in informal areas). There are significant differences by poverty level in the holdings of Class-1 and Class-2 durables, farm animals and entertainment equipment. The only significant, though small, difference between households in formal and informal area is the holding of farm animals.

Home values are relatively concentrated. The high number of missing or don't know responses to this question means that the averages shown are drawn from a relatively small group and tests of statistical significance were not possible.

**Table B.3: Household wealth composition**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Index of household wealth <sup>a</sup>	32.7	<b>24.5</b>	<b>33.2</b>	<b>29</b>	<b>39</b>	25.4	22.4
N	670	148	522	420	249	107	40
Household's average holdings of:							
Class-1 durables (furniture, pans, iron, mosquito net) [7]	5.8	5.5	5.8	<b>5.3</b>	<b>6.6</b>	5.5	5.4
Class-2 durables (stove, sewing machine, fan, wheelbarrow, water storage tank) [60]	1.4	1.2	1.4	<b>1.2</b>	<b>1.6</b>	1.2	1.3
Class-3 durables (refrigerator, washing machine, electric generator, bicycle) [100]	0.1	0.1	0.1	<b>0</b>	<b>0.2</b>	<b>0.1</b>	<b>0</b>
Farm animals (poultry and livestock) [200]	0.5	<b>0.2</b>	<b>0.5</b>	<b>0.6</b>	<b>0.3</b>	0.2	0.1
Entertainment equipment (radio, TV, satellite dish, DVD, video player) [80]	1.7	1.6	1.7	<b>1.3</b>	<b>2.3</b>	1.6	1.6
Motorized transport (motorcycle [400], car [1,000])	0.0	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.1</b>	0	0
N	670	148	522	420	249	107	40
Value of primary residence, not its land (in 1,000 KSh) <sup>b</sup>	-	-	-	-	-	-	-
N	670	148	522	420	249	107	40
Value of primary residence and its land (in 1,000 KSh) <sup>b</sup>	1,123	-	<u>1,123</u>	<u>805</u>	<u>2,287</u>	-	-
N	74	0	74	61	13	0	0
Value of other land and/or residence (in 1,000 KSh) <sup>c</sup>	457	-	<u>457</u>	<u>253</u>	<u>808</u>	-	-
N	17	0	17	12	5	0	0

**Notes:**

- This is a class-weighted average of the number of items as disaggregated in this same table, multiplied by the weight given within the square brackets [].
- About 89% of the sample had missing values for this amount, though at about the same frequency across the categories of this table. About half the sample that declared owning land or a residence failed to report its value. Averages are only over households with the asset. See "Proportion of Owners" in Table C.1. Please, note that values in the last three rows of the table are divided by one thousand.
- Since the survey does not ask the value of these, they have been imputed as a percent of primary residence value where it was declared (see Footnote (b)). These imputations are: land in city (10%), land outside city (5%), residence only in city (40%), and residence only outside of city (28%). If household has both land and structure these are scored separately and added together. In the case where the land of primary residence is not owned the value of the residence is first doubled before the imputations are made.

## B.4 Household Finance

Around 58% of all households in Machakos have a bank account, a number that does not significantly differ across any comparisons presented except for poverty level; whereas 84% of non-poor households own bank accounts, only 43% of poor households use them. However, the percentage of households with loans is extremely low, and most loans (2% of all households) are obtained from banks, mostly among non-poor households (4%). Consistent with findings mentioned above, far more households (38%) sent money to people not living at the household than received money (22%). Significantly more poor households receive money than non-poor households (25% vs. 16%), and the opposite is true when it comes to cash sent to those not living at residence—56% of non-poor households send cash vs. 28% of poor households.

**Table B.4: Household finance**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of households with a bank account	58	58	58	<b>43</b>	<b>84</b>	57	65
N	670	148	522	420	249	107	40
Percent of households with a loan	2	1	2	<b>0</b>	<b>5</b>	1	3
N	670	148	522	420	249	107	40
Percent of households with a loan from a...							
Bank	2	1	2	<b>0</b>	<b>4</b>	57	65
Microfinance institution	0	<u>0</u>	<u>0</u>	0	0	<u>0</u>	<u>0</u>
Savings/credit group or co-op	0	1	0	0	1	1	0
Relative/friend	0	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Informal lender	0	0	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
N	670	148	522	420	249	107	40
Percent of households receiving cash from those not now living at residence <sup>a</sup>	22	18	22	<b>25</b>	<b>16</b>	15	27
N	670	148	522	420	249	107	40
Percent of households sending cash to those not now living at residence <sup>a</sup>	38	37	38	<b>28</b>	<b>56</b>	42	25
N	670	148	522	420	249	107	40

Notes:

a. Over the previous twelve months.

## B.5 Household-Owned Business Profile

Only 11% of households own a business, most of which (72%) engage in some form of selling. These businesses tend to be fairly new and quite small, as the average age for a business is less than a year and the average number of employees is between one and two—in fact, the business owner is the sole employee in many cases. Most businesses in Machakos are not registered to the local authority, the Kenya Revenue Authority or the Registrar of Companies (78%), and only 17% said they registered to a

municipal or city council. Fifty-one percent of surveyed businesses pay a daily market local fee, and a quarter of them pay a single-business-permit local fee. The relatively low number of businesses means that it is not possible to perform tests of statistical significance for most of Table B.5.

**Table B.5: Household-owned business profile**

Characteristic	All	Location		Households poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of households with business ownership, last 12 months	11	9	11	9	14	7	15
N	670	148	522	420	249	107	40
Type of business: <sup>a</sup>							
Manufacturing	0	0	0	0	0	0	0
Selling	72	70	72	63	82	61	82
Transport	7	8	7	10	5	14	0
Professional (including Internet)	3	0	3	0	7	0	0
Other (barber, cleaning, etc.)	17	22	17	27	7	25	18
N	62	12	50	28	34	7	5
Years in operation	0.9	1.2	0.9	0.9	1.0	0.9	1.5
N	62	12	50	28	34	7	5
Number of employees	1.8	1.5	1.9	1.7	1.9	1.6	1.5
N	62	12	50	28	34	7	5
Which are...							
Household members	1.1	1.0	1.2	1.2	1.1	1.0	1.0
N	62	12	50	28	34	7	5
Non-household members	0.7	0.5	0.7	0.5	0.9	0.6	0.5
N	62	12	50	28	34	7	5
Revenue in previous month <sup>b</sup>	71,708	17,865	76,686	22,367	124,743	18,739	16,004
N	35	9	26	17	18	6	3
Registration status:							
Local authority (municipal or city council)	17	46	15	7	27	52	37
Kenya Revenue Authority	4	0	4	5	3	0	0
Registrar of Companies	4	0	5	0	9	0	0
None of the above	78	54	79	87	67	48	63
N	62	12	50	28	34	7	5
Share of businesses making fiscal contributions:							
Daily market local fee	51	67	50	50	52	57	82
Single business permit local fee	25	22	25	19	32	25	18
Value Added Tax	2	0	2	0	5	0	0
N	62	12	50	28	34	7	5

Notes:

- Households were allowed to choose more than one category so these figures may exceed 100%.
- Average over only those businesses operating over the period.

## DWELLING TENURE, SECURITY, AND CHARACTERISTICS

### C.1 Household Dwelling Characteristics

On average, households in Machakos have 1.8 people per room, a ratio that significantly differs by area type (2 on average among households in informal areas vs. 1.7 among households in formal settlements). Households have less than one bathroom on average. Twenty-four percent of households have a kitchen. This proportion is twice as high among non-poor households (35%) than among poor households (17%), and it proved statistically significant.

Most households in Machakos cook with charcoal or paraffin or kerosene, especially in the informal areas, where more than a half of households (55%) use charcoal and more than a third (37%) use kerosene. In contrast, larger proportions of households in formal settlements use gas and firewood for cooking than households in informal areas (13% and 21% of households in formal areas vs. 6% and 0% of households in informal settlements, respectively). Cooking fuel use also varies according to poverty level. Whereas a significantly higher proportion of non-poor households use gas (26% vs. only 4% of poor households), a larger percent of poor households use firewood (28% vs. 7% of non-poor households).

Sixty-two percent of Machakos households are renters, while 38% of them own their land and structure. Significantly more poor households than non-poor households are renters. Interestingly, the proportion of households that rent their dwelling is significantly larger among households in informal areas (91% vs. 60% of households in formal areas), but also among non-poor households (78% vs. 52% of poor households). In addition, the number of households that own land and structure in our sample is so small that it is not possible to state any assumptions regarding property ownership patterns.

People in Machakos report that they are quite susceptible to natural and manmade hazards. More than a quarter (28%) of households report that the area around their dwelling floods during heavy rains, 24% indicated their area is subject to mudslides, 10% said they live within a ten-minute walk of a formal or informal garbage dump, and 1% stated that they are exposed to factory pollution in their neighborhood. The threat of disaster typically displays significant differences between formal and informal settlements and poverty level. On the one hand, a smaller proportion of households in formal settlements reported their dwellings being susceptible to floods than households in informal areas (27% vs. 41%); a considerably smaller proportion of households in formal areas are close to formal or informal garbage dumps (9% vs. 29% of households in informal areas). On the other hand, significantly fewer non-poor households are susceptible to floods than poor households (20% vs. 32%), and a smaller proportion of non-poor households have suffered mudslides (16% vs. 29%).

Quality of housing does not register considerable variation across location. Eight percent of households have earth/clay floor, and there is only a significant difference between poor and non-poor households (11% vs. 4%). Almost all households in Machakos have corrugated iron or grass roofing (98%), and stone, brick or block walls (92%).

**Table C.1: Household dwelling characteristics**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Number of persons per room	1.8	<b>2.0</b>	<b>1.7</b>	1.8	1.6	2.1	1.7
N	669	148	521	419	249	107	40
Number of bathrooms	0.4	<b>0.6</b>	<b>0.4</b>	0.5	0.4	0.6	0.7
N	670	148	522	420	249	107	40
Proportion of residences with kitchen	24	23	24	<b>17</b>	<b>35</b>	23	25
N	670	148	522	420	249	107	40
Primary cooking fuel:							
Electricity	1	1	1	1	1	2	0
Paraffin or kerosene	26	<b>37</b>	<b>25</b>	23	29	36	39
Gas	12	<b>6</b>	<b>13</b>	<b>4</b>	<b>26</b>	5	10
Charcoal	42	<b>55</b>	<b>41</b>	45	36	58	51
Firewood	20	<b>0</b>	<b>21</b>	<b>28</b>	<b>7</b>	<u>0</u>	<u>0</u>
N	846	115	731	412	427	66	43
Proportion of households that:							
Total	100	100	100	100	100	100	100
Owens the land only	0	0	0	0	0	0	0
Owens structure only	0	0	0	0	0	0	0
Owens land and structure	38	9	40	48	22	<u>10</u>	<u>8</u>
Rents	62	<b>91</b>	<b>60</b>	<b>52</b>	<b>78</b>	90	92
Squats	0	0	0	0	0	0	0
N	670	148	522	420	249	107	40
Pct. of households in areas subject to <sup>a</sup> :							
Flooding <sup>b</sup>	28	<b>41</b>	<b>27</b>	<b>32</b>	<b>20</b>	40	44
Mudslides <sup>c</sup>	24	19	25	<b>29</b>	<b>16</b>	17	25
10 minute walk to formal or informal garbage dump	10	<b>29</b>	<b>9</b>	9	13	27	37
Factory pollution (air, water, noise)	1	<b>3</b>	<b>0</b>	<b>1</b>	<b>0</b>	3	2
N	670	148	522	420	249	107	40
Housing quality:							
Pct. with earth/clay floor	8	4	8	<b>11</b>	<b>4</b>	4	5
Percent with corrugated iron roof	98	100	98	<b>100</b>	<b>95</b>	<u>100</u>	<u>100</u>
Percent with grass roof	0	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Percent with stone/brick/block walls	92	96	92	90	96	96	95
N	670	148	522	420	249	107	40

**Notes:**

- All data is self-reported, and therefore subjective.
- Households reported that the area floods during heavy rains.
- Households reported that they are located on a hillside that is subject to mudslides.

## C.2 Home and Land Ownership

Most households in Machakos are renters (62%), with 38% of them owning their land and structure. Seventy-nine percent of households owning their structure reported feeling secure in their ownership. A considerable portion of owner households (45%) reported having a freehold title for their land, 7% of them hold a government certificate of title, and 45% reported no land possession documents whatsoever. No households reported being evicted.

The bottom portion of Table B.2 focuses on neighborhood mobility. Households reported living an average of eight years in their present dwelling and about a year longer in their present neighborhood. On average, households located in formal areas stay almost two-years longer in the dwelling and slightly more-than-two-years longer in the neighborhood than households in informal areas. Interestingly, on average poor households seem to live more than three-years longer in their dwellings than non-poor households.

**Table C.2: Household residence and land tenure**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of households that:							
Total	100	100	100	100	100	100	100
Own the land only	0	0	0	0	0	0	0
Own structure only	0	0	0	0	0	0	0
Own land and structure	38	9	40	48	22	10	8
Rent	62	<b>91</b>	<b>60</b>	<b>52</b>	<b>78</b>	90	92
Squat	0	0	0	0	0	0	0
N	670	148	522	420	249	107	40
Percent of households that feel secure in ownership	79	<u>100</u>	<u>79</u>	<u>76</u>	<u>91</u>	<u>100</u>	<u>100</u>
N	193	13	180	149	44	10	3
Variability of households feeling secure <sup>a</sup>	0.02	-	0.02	0.03	0.00	-	-
N	193	13	180	149	44	10	3
Percent of households that experienced eviction	0	0	0	0	1	0	0
N	670	148	522	420	249	107	40
Proportion of household owners by type of land-possession document:							
Total	100	100	100	100	100	100	100
None	45	<u>17</u>	<u>45</u>	<u>51</u>	<u>24</u>	<u>15</u>	<u>24</u>
Freehold title	45	<u>83</u>	<u>45</u>	<u>40</u>	<u>61</u>	<u>85</u>	<u>76</u>
Temporary occupation license	2	<u>0</u>	<u>2</u>	<u>1</u>	<u>3</u>	<u>0</u>	<u>0</u>
Share certificate	2	<u>0</u>	<u>2</u>	<u>1</u>	<u>3</u>	<u>0</u>	<u>0</u>
Government certificate of title <sup>b</sup>	7	<u>0</u>	<u>7</u>	<u>7</u>	<u>6</u>	<u>0</u>	<u>0</u>
Letter from chief (provincial administration)	0	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Other	0	0	0	0	0	0	0
N	200	15	185	152	48	11	4
<b>Neighborhood mobility</b>							
Years in dwelling	8.0	<b>6.2</b>	<b>8.1</b>	<b>9.3</b>	<b>5.8</b>	5.9	7.1
N	670	148	522	420	249	107	40
Years in neighborhood	9.1	<b>7.1</b>	<b>9.3</b>	10.0	7.8	6.9	8.0
N	670	148	522	420	249	107	40
Home loan payment as a percent of spending power <sup>c</sup>	45	<u>12</u>	<u>47</u>	-	<u>45</u>	<u>12</u>	-
N	3	1	2	0	3	1	0

*Notes:*

- Computed as the intra-class correlation coefficient, where the “class” is the EA. This measures the extent to which households within an EA resemble each other in their feelings of security in ownership. No significance tests performed on this row.
- Long-term lease from City council/Government.
- Computed only for those with a housing loan.

### C.3 Distribution of Housing Values and Rents

The average value of homes in Machakos is 1.1 million KSh and 91% of respondents reported their home values to be between 9,000 KSh and 2.5 million KSh. Note that very few households—74 in total—reported home values, so these results are likely unreliable.

Average rent is 2,568 KSh per month. Although most differences in rent amounts cannot be tested for significance across categories, there is a significant difference between male- and female-headed households whose rent range is 1,500-1,999 KSh. However, this could be related to the general distribution of households, the majority being headed by males.

**Table C.3: Distribution of housing values and rents**

Characteristic	All	Location		Household has...			Household head is... <sup>c</sup>		Gender (Informal)	
		Informal areas	Formal areas	Tenure	Water connection	A business	Skilled	Unskilled	Male-headed	Female-headed
Average home value (1,000 KSh) <sup>a</sup>	1,123	-	<u>1123</u>	<u>1,123</u>	<u>2,000</u>	<u>9967</u>	<u>1046</u>	<u>1,143</u>	-	-
N	74	0	74	74	1	2	18	56	0	0
Distribution of home values: <i>Total</i>	100	-	100	100	100	100	100	100	-	-
1-8,999 KSh	0	-	<u>0</u>	0	0	0	<u>0</u>	<u>0</u>	-	-
9,000-299,999 KSh	24	-	<u>24</u>	<u>24</u>	<u>0</u>	<u>0</u>	<u>6</u>	<u>28</u>	-	-
300,000-999,999 KSh	41	-	<u>41</u>	<u>41</u>	<u>0</u>	<u>35</u>	<u>46</u>	<u>40</u>	-	-
1,000,000-2,499,999 KSh	26	-	<u>26</u>	<u>26</u>	<u>100</u>	<u>0</u>	<u>45</u>	<u>20</u>	-	-
2,500,000-250,000,000 KSh	10	-	<u>10</u>	<u>10</u>	<u>0</u>	<u>65</u>	<u>2</u>	<u>12</u>	-	-
N	74	0	<u>74</u>	74	1	2	18	56	0	0
Average monthly rent (tenants) <sup>b</sup>	2,568	<u>2,093</u>	<u>2,615</u>		<u>6,392</u>	<u>2,563</u>	<u>3,543</u>	<u>2,143</u>	<u>2,088</u>	<u>2,143</u>
N	468	134	334		37	50	139	329	97	36
Distribution of monthly rents: <i>Total</i>	100	100	100		100	100	100	100	100	100
1-899 KSh	9	<u>13</u>	<u>9</u>		<u>0</u>	<u>17</u>	<u>1</u>	<u>13</u>	14	9
900-1,499 KSh	22	<u>19</u>	<u>22</u>		<u>4</u>	<u>18</u>	<u>16</u>	<u>24</u>	16	27
1,500-1,999 KSh	16	<u>18</u>	<u>15</u>		<u>3</u>	<u>4</u>	<u>7</u>	<u>19</u>	<b>22</b>	<b>6</b>
2,000-3,499 KSh	31	<u>33</u>	<u>30</u>		<u>3</u>	<u>38</u>	<u>34</u>	<u>29</u>	30	40
3,500-150,000 KSh	23	<u>17</u>	<u>23</u>		<u>90</u>	<u>23</u>	<u>42</u>	<u>15</u>	17	18
N	468	134	334		37	50	139	329	97	36

**Notes:**

- a. Self-reported, current, monthly, fair-market price (response to the question, "If you were to sell your house, how much do you think you could sell it for?").
- b. Excludes imputed owner-occupied rents.
- c. Includes those self-declared as "skilled" as well as "professional".

### C.4 Neighborhood Social Capital and Civic Participation

Respondents that own their homes are more likely than renters to participate in their community. Twenty percent of owners attended local councils (compared to only 9% of renters) and 40% attended neighborhood forums (compared to 10% of renters); both differences are significant. Furthermore, household members from formal areas are twice as likely to attend neighborhood forums as individuals living in informal settlements (22% vs. 10%). Owners are also more likely to have voted in the 2007 general elections (74% vs. 57% of tenants), and to have participated at the 2010 referendum (77% vs. 60% tenants). These differences are statistically significant.

Most households (68%) reported that they had an informal community or neighborhood leader. They concentrate among households in the lower half of access to infrastructure (73%) and among those households that own their dwellings (77% of them vs. 62% of renters). Very few respondents (2%) said that they had participated in a public demonstration or protest.

The survey asked respondents whether people in their neighborhood would cooperate if asked by an official to conserve water or electricity because of an emergency, and whether people in their neighborhood look out for each other. On both questions, the results were positive. When asked if people in their community would cooperate if asked by an official, the results averaged 2.9 on a four-point scale (where 4=“very likely” and 1=“very unlikely” to cooperate). In Machakos, when respondents were asked if they agreed that people look out and trust each other in their neighborhood, answers averaged 3.1 on a five-point scale (where 1=“strongly disagree” and 5=“strongly agree”). On both questions, there were only slight differences between owners and tenants, and people with high and low access to infrastructure (only in the question about people looking out and trusting each other in their neighborhood). Eighty-two percent of respondents said they felt safe in their own neighborhood. The only statistically significant difference was by household location. In formal areas, 83% of respondents felt safe in their own neighborhood compared to 68% of respondents in informal settlements.

**Table C.4a: Neighborhood social capital and civic participation**

Characteristic	All	Location		Access to infrastructure <sup>a</sup>		Gender (Informal)		Tenure <sup>b</sup>	
		Informal areas	Formal areas	Lower half	Upper half	Male-headed	Female-headed	Own	Rent
<b>Civic participation</b>									
Percent of households... contacting local council	13	9	14	15	11	11	6	<b>20</b>	<b>9</b>
N	670	148	522	391	279	107	40	192	478
attending a neighborhood forum	21	<b>10</b>	<b>22</b>	23	18	8	14	<b>40</b>	<b>10</b>
N	670	148	522	391	279	107	40	192	478
<b>Social activism</b>									
Percent of households voting in...local election <sup>c</sup>	33	<b>23</b>	<b>33</b>	34	31	23	22	40	28
N	670	148	522	391	279	107	40	192	478
2007 general election <sup>c</sup>	63	64	63	62	65	62	70	<b>74</b>	<b>57</b>
N	670	148	522	391	279	107	40	192	478
2010 referendum <sup>c</sup>	66	62	67	67	66	64	60	<b>77</b>	<b>60</b>
N	670	148	522	391	279	107	40	192	478
Percent of households with informal community or neighborhood leader	68	65	68	<b>73</b>	<b>59</b>	69	57	<b>77</b>	<b>62</b>
N	594	132	462	342	252	96	35	178	416
Percent of households that took part in a public demonstration or protest	2	1	2	1	2	1	0	1	2
N	670	148	522	391	279	107	40	192	478

Notes:

- Defined by dividing the population in half based on a score assigned using responses from thirteen infrastructure-related questions (see Section 3 of Introduction).
- Alternatively, this could be the length of time living in the neighborhood: less/more than (say) 2 years.
- Out of all households and not just those registered to vote.

**Table C.4b: Neighborhood social capital and civic participation**

Characteristic	All	Location		Access to infrastructure <sup>a</sup>		Gender (Informal)		Tenure <sup>b</sup>	
		Informal areas	Formal areas	Lower half	Upper half	Male-headed	Female-headed	Own	Rent
<b>Social capital</b>									
Average household response to:									
People in my neighborhood cooperate if asked by an official <sup>c</sup>	2.9	2.8	2.9	2.9	2.9	2.8	2.7	<b>3.3</b>	<b>2.7</b>
N	669	148	521	390	279	107	40	192	477
People in my neighborhood look out for/trust each other <sup>d</sup>	3.1	3.1	3.1	<b>3.1</b>	<b>3.1</b>	3.1	3.1	<b>3.6</b>	<b>2.9</b>
N	670	148	522	391	279	107	40	192	478
Proportion of households feeling safe from crime in own neighborhood	82	<b>68</b>	<b>83</b>	83	80	71	60	86	79
N	670	148	522	391	279	107	40	192	478

**Notes:**

- a. Defined by assigning scores using responses from thirteen infrastructure-related questions.
- b. Alternatively, this could be the length of time living in the neighborhood: less/more than (say) 2 years.
- c. Four-point scale where 1="Very unlikely" to 5="Very likely".
- d. Five-point scale where 1="Strongly disagree" to 5="Strongly agree".



### D.1a Water Access

Only 7% of households have a private piped water connection in their dwelling, a proportion which is significantly higher among non-poor households (16%) than among poor households (1%). An additional 17% have piped water in their compound. This varies significantly by tenure status, area type, poverty level and respondents security in their home ownership, where “secure” represents owners who feel no one could force them to leave without an official legal process in which they would participate, “insecure” represents owners who feel they could be forced out, and “rent” represents those who rent their homes and therefore have no security of ownership as well as squatters and those who own their dwelling but not land. Finally, 49% of households are close (within 50 meters) to a source of piped water.

On average, it takes respondents over two hours a day to obtain water, including travel to and from the water source, waiting time, and filling time. Water costs an average of 634 KSh a month. Although there was not enough data at the census tract level to test for statistically significant differences between categories of households for the cost of water in time or money, we note that there are numerical differences. Households in informal areas spend less time and money obtaining water than those in formal areas, poor households spend a half of the amount non-poor households do in water supply, perhaps reflecting an overall lack of resources to devote to obtaining water.

Seven percent of households have piped water in their dwellings, and only 5% of respondents report that piped water is their *most important* water source. Thirty-seven percent of households in Machakos primarily obtain water from wells or boreholes, and 30% consider other vendors—kiosk or tanker—as their most important water source. Another 13% mentioned shared tap connections as most important, and still 10% of them primarily obtain water from other natural sources outside the household, like rivers or lakes. Non-poor households are more likely than poor households to obtain water from piped, shared tap connections, vendors and even bottled water, and are less likely to use wells, boreholes or other natural sources outside the household; all these differences are statistically significant. The use of shared tap connections is considerably less common in formal areas than in informal settlements (13% vs. 21%), and interestingly, those households that use other natural sources—no wells/boreholes—to obtain water are only located in formal settlements (12%), as no households in informal areas use such natural sources. Of the households that did not have access to piped water, the main reason given (31%) was because there was no service available in the area; the second most common reason (29%) was they rented rather than owned their home and their landlord would not pay for a connection. Eighteen percent of households declared their inability to afford the initial connection (although only 12% were unable to afford a water bill). Only 7% of respondents reported that the water provider had a waiting list, and 1% said they had other sources available.

**Table D.1a: Water access**

Characteristic	All	Security of Ownership <sup>a</sup>			Location		Household poverty		Gender (Informal)	
		Secure	Insecure	Rent	Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of households with private piped water connection inside dwelling	7	3	0	9	5	7	1	16	3	9
N	670	156	37	477	148	522	420	249	107	40
Percent of households with piped water connection in compound	17	10	4	22	27	16	12	25	23	37
N	670	156	37	477	148	522	420	249	107	40
Percent of households close to piped water access <sup>b</sup>	49	35	9	65	80	48	42	67	77	88
N	511	136	35	340	109	402	356	154	82	26
Monthly cost of water in Time (minutes) <sup>c</sup>	922	1319	790	698	768	931	919	929	774	746
N	513	137	34	342	110	403	361	151	82	27
Money (KSh)	634	649	546	632	495	645	418	968	511	445
N	510	106	14	390	125	385	320	189	92	32
Most important water source: <i>Total</i>	100	100	100	100	100	100	100	100	100	100
Piped	5	2	0	8	5	5	1	12	3	9
Bottled	2	2	1	2	0	2	1	5	0	0
Shared tap connection	13	5	4	19	21	13	10	19	20	25
Vendor (kiosk, tanker, other)	30	11	10	42	37	30	26	38	37	34
Neighbor(s)	1	4	0	0	1	1	1	1	1	0
Well/borehole	37	56	29	29	37	37	47	19	39	32
Natural source outside household	11	21	56	1	0	12	15	6	0	0
N	669	156	36	477	148	521	419	249	107	40
No connection due to:	100	100	100	100	100	100	100	100	100	100
Other sources available	1	2	0	2	0	2	1	2	0	0
Renting <sup>d</sup>	29	3	0	51	63	27	27	35	65	58
Can't afford connection	18	24	17	14	6	18	18	16	7	4
Can't afford monthly bill	12	14	10	12	20	12	12	12	20	21
Provider has waiting list	7	4	4	10	3	8	5	13	3	5
No service available	31	53	68	12	6	33	36	21	6	9
Other	1	1	0	1	1	1	0	2	0	4
N	510	136	35	339	109	401	356	153	82	26

**Notes:**

- Self-reported; "secure" includes owners who feel no one could force them to leave without an official legal process in which they would participate, "insecure" includes owners who feel they could be forced to leave without an official legal process, and "rent" includes renters, squatters, and people who own their structure but not land.
- Respondents were asked whether there were dwellings or businesses within 50 meters of their home that had a piped water connection in the dwelling or compound.
- Calculated as the sum of time spent travelling, waiting in line, and filling containers.
- House does not have a connection and landlord will not pay for one.

## D.1b Water Quality

Water quality is generally rated “good” or “fair,” although 88% of the households that obtain water from wells or boreholes and 68% using wells or boreholes rate their water quality to be fair or poor. The difference between the proportion of households that declared the quality of water from shared tap connections was good (33%) and fair (67%) was statistically significant; it was also significant for wells/boreholes (14% good, 84% fair). The distributions of good/fair/poor ratings of water quality were statistically significant for piped water (23% good, 66% fair, and 11% poor), water from vendors (28% good, 67% fair, and 5% poor), and water from wells/boreholes (14% good, 84% fair, 2% poor). The fact that 11% of respondents with piped water rated their water quality as “poor” is particularly surprising.

Almost all respondents purchase their water from a public utility (89%). Only 39% of the households in Machakos treat their water in any way; of those that treat water, most boil it (31%) or add bleach or chlorine (26%).

**Table D.1b: Water quality**

Characteristic	All	Household poverty		Location		Water quality					Gender (Informal)	
		Poor	Non-poor	Informal areas	Formal areas	Good	Fair	Poor	Total	N	Male-headed	Female-headed
Water source: <sup>a</sup> Piped	5	1	12	5	5	23	66	11	100	36	3	9
Bottled	2	1	5	0	2	29	71	0	100	10	0	0
Shared tap connection	13	10	19	21	13	33	67	0	100	107	20	25
Other vendor	30	26	38	37	30	28	67	5	100	196	37	34
Neighbor(s)	1	1	1	1	1	0	100	0	100	6	1	0
Well/Borehole	37	47	19	37	37	14	84	2	100	264	39	32
Natural outside-household source	11	15	6	0	12	32	68	0	100	50	0	0
N	669	419	249	148	521	149	503	17			107	40
Water provider: Public	89	84	92	92	89	29	68	3	100	142	96	86
Private	4	7	2	0	4	0	100	0	100	3	0	0
Self	6	7	5	8	5	44	56	0	100	12	4	14
Community	2	1	2	0	2	100	0	0	100	2	0	0
N	159	64	95	39	120	52	103	4			25	14
Percent of households treating drinking water	39	28	59	39	39	22	75	3	100	242	39	40
N	668	420	247	148	520	149	503	16			107	40
Treatment method: <sup>b</sup> Boiling	31	29	33	38	31	25	70	6	100	84	45	21
Add bleach/chlorine	26	74	74	79	74	19	77	4	100	179	39	15
Other (sieve, filter, settle)	5	2	7	2	5	36	55	9	100	10	2	0
N	242	101	140	54	188	50	184	8			39	15

**Notes:**

- Most important water source.
- Since multiple responses were permitted, the sum can exceed 100%. Likewise, “Other” is not shown, since it was negligible, so the sum may also be less than 100%.

## D.2a Electricity and Waste-Disposal Services

Fifty-three percent of respondents reported access to electricity, a figure that differs significantly by poverty level (71% of non-poor vs. 42% poor). Reasons for not having a connection are similar to those for water—the primary reason reported was their inability to pay for the initial connection (46%), followed by households that did not own their home and didn't have a choice (26%). Only 12% of respondents reported functional street lighting in their area, which differs significantly between non-poor and poor households (17% vs. 9%).

In Machakos, the average monthly bill for those with electricity is 675 KSh a month. Sixteen percent of households with electricity do not pay for it. Electricity payments are primarily made to the public utility (97%), although a few respondents pay their landlord instead (3%). Even when electricity is available, it is not particularly reliable; 28% of respondents experience outages on a weekly basis or more.

Thirty-eight percent of all households reported getting rid of their refuse by dumping it in their neighborhood or compound; this is significantly more common among households in informal areas than in formal settlements. Thirty-one percent of respondents declare they burn their refuse; however, the proportion of households in formal settlements that burn for refuse disposal is twice as large as that of households in informal areas (32% vs. 16%). Moreover, a considerably larger proportion of poor households burn their refuse than of non-poor households (38% vs. 20%).

Non-poor households are almost twice as likely to use a collection system as poor households in, respectively (19% vs. 10%). Interestingly, the proportion of households in informal areas that use a collection system to dispose of refuse is considerably larger than of households in formal areas (30% vs. 13%).

**Table D.2a: Access to electricity and waste-disposal**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
<b>Electricity</b>							
Proportion of households with access to electricity	53	60	53	<b>42</b>	<b>71</b>	59	64
N	670	148	522	420	249	107	40
Reason for no connection: <i>Total</i>	100	100	100	100	100	100	100
Renters	26	<u>61</u>	<u>24</u>	<u>22</u>	<u>38</u>	<u>63</u>	<u>52</u>
Firm has waiting list	9	<u>0</u>	<u>9</u>	<u>7</u>	<u>16</u>	<u>0</u>	<u>0</u>
Cannot afford connection	46	<u>31</u>	<u>46</u>	<u>49</u>	<u>34</u>	<u>27</u>	<u>48</u>
Cannot afford monthly bill	20	<u>8</u>	<u>20</u>	<u>22</u>	<u>12</u>	<u>10</u>	<u>0</u>
Other	0	0	0	0	0	0	0
N	292	59	233	224	68	42	16
Percent of households with mostly functioning street lighting	12	17	12	<b>9</b>	<b>17</b>	18	15
N	670	148	522	420	249	107	40
Average monthly bill, KShs	675	<u>476</u>	<u>688</u>	<u>561</u>	<u>761</u>	<u>561</u>	<u>300</u>
N	670	148	522	420	249	107	40
Percent of households not paying for electricity	16	<u>7</u>	<u>17</u>	<u>26</u>	<u>7</u>	<u>10</u>	<u>0</u>
N	210	40	170	97	113	28	12
Payment to: <i>Total</i>	100	100	100	100	100	100	100
Utility	97	<u>86</u>	<u>98</u>	<u>97</u>	<u>97</u>	<u>90</u>	<u>78</u>
Prepaid card	0	0	0	0	0	0	0
Landlord	3	<u>12</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>10</u>	<u>15</u>
Third party (from utility power line)	0	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>7</u>
N	172	36	136	65	107	24	12
Percent of households with outages at least once weekly	28	<u>32</u>	<u>28</u>	<u>22</u>	<u>34</u>	<u>31</u>	<u>34</u>
N	378	89	289	196	181	65	24
<b>Refuse disposal</b>							
Main method:							
Dumping	38	<b>50</b>	<b>37</b>	34	45	51	49
Burying	16	<b>3</b>	<b>17</b>	16	16	3	3
Burning	31	<b>16</b>	<b>32</b>	<b>38</b>	<b>20</b>	17	10
Collection system <sup>a</sup>	14	<b>30</b>	<b>13</b>	<b>10</b>	<b>19</b>	28	38
N	670	148	522	420	249	107	40
Proportion of households paying for collection	5	<u>0</u>	<u>6</u>	<u>6</u>	<u>4</u>	<u>0</u>	<u>0</u>
N	123	43	80	63	60	28	15

Notes:

a. Run by city, community, or private firm.

## D.2b Access to Sanitation Services

Only 12% of households reported that they have a toilet in their home, and this significantly varies by poverty level; whereas 26% of non-poor households have a toilet at home, only 4% of poor households have one. Most households use a pit latrine (77%) or a flush toilet (22%). Non-poor households are much more likely to use a flush toilet and less likely to use a pit latrine. The majority of households (59%) share a toilet with several other families. Compared to households in informal areas, significantly more households in formal areas do not share toilets at all, while significantly fewer share with 10 or more other households. Most toilets (78%) drain into pits; 18% of households use toilets connected to a sewage system, and only 4% have a septic tank instead.

**Table D.2b: Access to sanitation**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of households with toilet in home	12	13	12	4	26	11	19
N	670	148	522	420	249	107	40
Type of toilet system: <i>Total</i>							
Pit latrine (individual)	77	74	77	86	62	76	69
VIP latrine	1	0	1	1	2	0	0
Flush toilet/WC	22	26	22	14	36	24	31
Public/shared latrine	0	0	0	0	0	0	0
Paid shared latrine	0	0	0	0	0	0	0
N	670	148	522	420	249	107	40
Percent of households sharing toilet:							
Doesn't share	41	17	42	40	43	15	22
Shares with 2-9 other households	45	49	45	46	43	51	44
Shares with 10+ other households	14	35	13	14	14	34	35
N	670	148	522	420	249	107	40
Type of disposal system for toilet:							
Total	100	100	100	100	100	100	100
Pit latrine	78	69	78	83	68	71	61
Sewer (legal)	18	19	18	12	28	18	23
Sewer (informal)	1	4	0	0	1	2	9
Septic tank/soak pit	4	8	3	5	2	9	6
N	670	148	522	420	249	107	40
Disposal of "grey water": <i>Total</i>							
Total	100	100	100	100	100	100	100
Dump into drain	9	11	9	5	16	13	6
Pour onto road	71	87	70	69	75	84	94
Pour into latrine	1	0	2	2	1	0	0
Other	18	2	19	24	8	3	0
N	669	148	521	419	249	107	40

“Grey water” (waste water from washing, cleaning, etc.) is generally poured out into the road (71%) or dumped down the drain (9%). Households in informal settlements are more likely to pour their grey water into the street, and non-poor households are more likely to dump them down the drain.

### D.3 Access to Transport

Most individuals in Machakos (60%) work or study inside their neighborhood rather than outside; there are no statistically significant differences across categories. Practically all respondents commute on foot (69%) or via a matatu (28%).<sup>11</sup> Students and poor household members are significantly more likely to walk than workers, and typically less likely to use a matatu. Only 1% of non-poor households drove to work or school in their own vehicle.

Average one-way transport time is 22 minutes. Respondents take slightly longer trips to school than to work; individuals from households in formal settlements and non-poor households also take slightly longer trips than household members in informal areas and poor households, but these results are not significant. Of the respondents that pay to travel, the average one-way cost is 92 KSh.

Fifty-eight percent of respondents said that their access to roads is generally poor. Interestingly, more non-poor households find their road access poor (68%) than poor households (53%). Twenty-one percent of households overall have limited road access during the rainy season.

**Table D.3: Access to transport**

Characteristic	All	Household activity <sup>a</sup>		Location		Household poverty		Gender (Informal)	
		Work	Study	Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent who work or study...									
inside the neighborhood	60			65	59	62	56	67	59
outside the neighborhood	39			34	39	36	43	32	41
inside <i>and</i> outside the neighborhood	1			1	1	1	2	2	0
N	900			193	707	524	376	141	50
Main mode of travel <sup>b</sup> Walk	69	<b>65</b>	<b>79</b>	70	69	<b>80</b>	<b>52</b>	69	69
Bicycle	0	0	0	0	0	0	0	0	0
Own vehicle	0	0	0	0	0	<b>0</b>	<b>1</b>	0	0
Matatu	28	<b>32</b>	<b>19</b>	28	28	<b>19</b>	<b>43</b>	28	27
Shared taxi	0	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	0	0	1	0
Bike taxi	2	<b>2</b>	<b>1</b>	2	2	<b>1</b>	<b>3</b>	2	2
Municipal bus	0	0	0	0	0	0	0	0	0
N	1,252	162	88	250	1,002	760	492	185	63
Transport time (minutes)	22	<b>18</b>	<b>19</b>	19	22	21	25	20	16
N	1,235	160	86	246	989	759	476	181	63
One-way trip cost to work/school (KSh)	92	<u>45</u>	<u>61</u>	<u>48</u>	<u>95</u>	<u>72</u>	<u>107</u>	<u>51</u>	<u>41</u>
N	336	53	16	69	267	144	192	51	18

<sup>11</sup> A “matatu” is a 14-seater minivan used throughout Kenya as a form of public transport.

Characteristic	All	Household activity <sup>a</sup>		Location		Household poverty		Gender (Informal)	
		Work	Study	Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Households with road access as:	58			68	58	53	68	66	76
Poor									
Good	42			32	42	47	32	34	24
N	669			147	522	420	248	106	40
Percent of households with limited road access during rainy season	21			27	21	18	27	28	22
N	670			148	522	420	249	107	40

Notes:

a. Informal areas only.

b. To work or to school. May not add to 100% since "Other", which was negligible, is not reported in table.

## D.4 Access to Communications

While land lines are practically nonexistent among households in Machakos, mobile phone ownership is widespread. The average household owns 1.7 mobile phones. The number owned varies significantly by poverty level (on average, 2.1 mobile phones among non-poor households vs. 1.4 phones among poor households). A remarkably large number of those with mobile phones use mobile banking (75%), with significant differences by poverty. On the other hand, relatively few respondents have a computer (5%), though the rate of computer ownership is significantly higher in formal areas and among non-poor households. Only 15% reported accessing the internet using any means, a figure which is significantly higher among households in formal settlements than informal settlements (16% vs. 8%), and among non-poor households than poor households (34% vs. 4%).

Table D.4: Access to communications

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Percent of households with functioning land line	0	1	0	0	0	1	0
N	670	148	522	420	249	107	40
Average number of mobile phones owned by household	1.7	1.6	1.7	1.4	2.1	1.7	1.4
N	669	148	521	419	249	107	40
Percent of households using mobile banking	75	79	74	65	91	80	74
N	670	148	522	420	249	107	40
Percent of households with functioning computer	5	1	6	1	12	0	2
N	670	148	522	420	249	107	40
Percent of households using internet (any means)	15	8	16	4	34	8	9
N	670	148	522	420	249	107	40

## D.5 Access to Infrastructure Indicator

The access to infrastructure indicator combines six categories of infrastructure (divided into 13 subcategories) weighted by importance to the household and summed to create a household indicator from 0 to 9.5.<sup>12</sup> Higher scores represent better access to infrastructure. This indicator provides an overall understanding of a household's infrastructure access. By averaging households' scores on the indicator, we can quickly compare infrastructure access in informal and formal areas, between poor and non-poor households, and between male- and female-headed households in informal areas.

Table D.5 presents household mean scores on the access-to-infrastructure indicator. The mean score across all households in Machakos is 3.51. Non-poor households score significantly higher than poor households, and the difference in mean scores is quite large—greater than one.

**Table D.5: Access to infrastructure indicator**

Characteristic	All	Location		Household poverty		Gender (Informal)	
		Informal areas	Formal areas	Poor	Non-poor	Male-headed	Female-headed
Mean score on access to infrastructure indicator	3.51	3.46	3.51	<b>3.11</b>	<b>4.18</b>	3.44	3.57
N	670	148	522	420	249	107	40

<sup>12</sup> The 13 subcategories are: piped water (1 point); shared/indirect connection (0.5 points); direct electricity access (1); street lighting (0.5); garbage collection system (1); own toilet (1); shared toilet with less than 20 other people (0.5); legal sewer system for toilet (0.5); grey water not poured onto street (0.5); good road access at dwelling (0.5); road access not limited during rainy season (0.5); no flooding (1); no mudslides (1).

# CONCLUSIONS

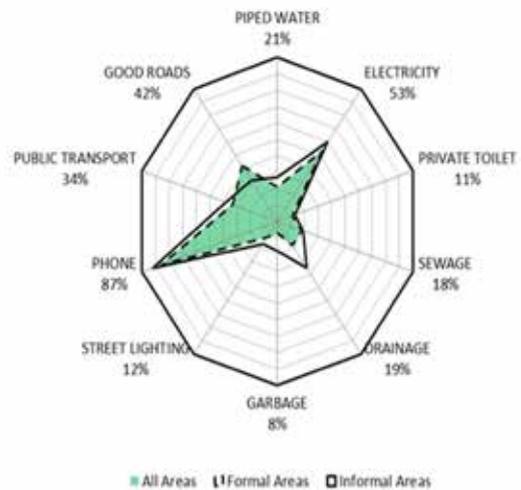
The following three figures are “Development Polygons”. These polygons are meant to complement the detailed tables presented in sections A through D by illustrating an “overall” sense of the state of the city. We present information for all areas, along with formal and informal areas, in each of the three figures: the Development Diamond, the Infrastructure Polygon, and the Living Conditions Diamond<sup>13</sup>. In all figures, the value labels included provide the value of the indicator for all areas. The statistics presented in these figures, of course, remain in the tables above. Similar graphics are also found in the City-at-a-Glance Reports and the Overview Report.

The axes for all figures represent percentages. Polygons with larger areas represent “better” situation in regards to the data provided. Hence, a polygon with full coverage would indicate that the city is doing very well in terms of development, infrastructure, or living conditions.

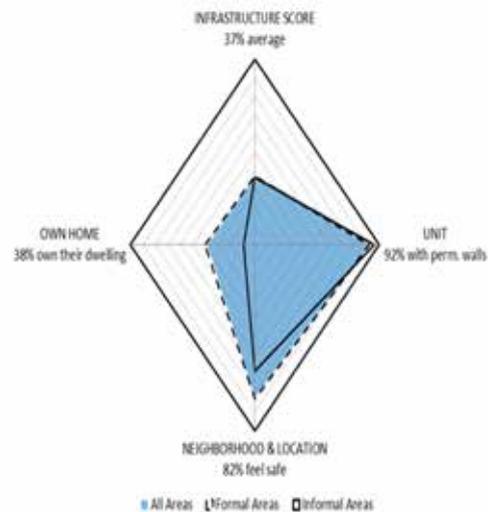
The Development Diamond (Figure 1) maps four indicators of poverty—welfare, employment, education, and living conditions. In three quarters of the development diamond—employment, education and living conditions—formal and informal areas are similarly situated. However, households in formal areas outpace the households in informal areas in terms of welfare conditions—in informal areas, a much larger percentage of households are poor than in formal areas (47% in informal areas, 37% in formal areas, and 21% overall). Although similar in both location types, the living conditions indicator in Machakos only covers 7% of the area, meaning that only 7% of households have water, electricity and permanent wall. This indicator increases to 15% among non-poor households.

The Infrastructure Polygon, shown in Figure 2, presents residents’ access to ten different types of infrastructure – piped water, electricity, private toilets, sewage, drainage, garbage collection, street lighting, mobile phones, public transport, and good roads. In Machakos, interestingly, piped water and

**Figure 1: Development Diamond**



**Figure 2: Infrastructure Polygon**

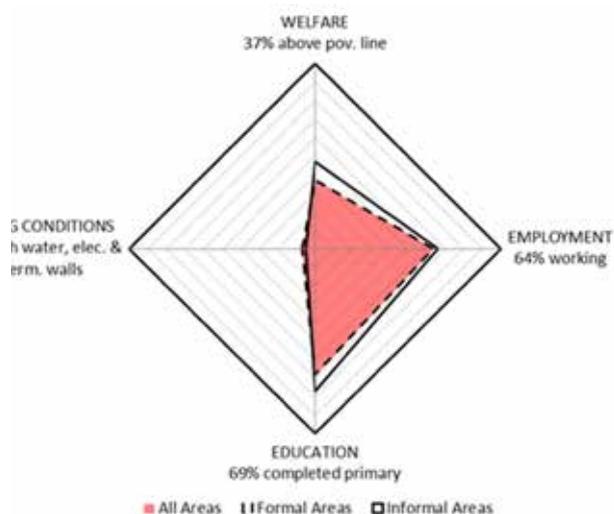


<sup>13</sup> The basic format for all three figures appear in the World Bank Policy Research Working Paper, “Poverty, Living Conditions, and Infrastructure Access” A Comparison of Slums in Dakar, Johannesburg, and Nairobi” by Sumila Gulyani, Debabrata Talukdar, and Darby Jack (2010). We strived to make our own figures as similar as possible, though some deviations, noted in the accompanying text, were necessary.

electricity are much more prevalent in informal areas (27% and 60%, respectively) than formal areas (21% and 53%). Private toilets are much less common overall, but we still find large differences on a similar pattern to electricity and piped water by area type – 13% of households in informal areas, compared to 11% in formal areas, have a private toilet. Sewage does not register considerable differences between area types. Nineteen percent of households have drainage, but informal areas are more likely to have this infrastructure than formal areas (35% vs. 18%). Also, more households in informal areas have garbage collection than in formal areas (18% vs. 7%). Interestingly, more households in informal areas report functioning street lighting than do households in informal areas – 17% versus only 12%. Mobile phone usage is nearly ubiquitous, as 92% of households in informal areas and 86% of households in formal areas own one or more mobile phones. About 34% of all households report that they use public transport (38% in informal areas and 33% in formal areas), and less than a half report good roads (42%).

Figure 3 presents the Living Conditions Diamond. The four axes of this diamond are the infrastructure score (scaled to a percentage), unit conditions, neighborhood and location, and home ownership. Two indicators, unit and neighborhood conditions, have coverage above 65%, with informal areas scoring above formal areas in unit conditions (96% of households have permanent walls) compared to formal areas (only 92% have permanent walls). In contrast, informal areas, as expected, perform below formal areas on neighborhood conditions and home ownership. Eighty-two percent of all households feel safe in their neighborhood. The largest difference between formal and informal areas occurs on home ownership – 40% of households in formal areas own their dwelling, while only 9% of households in informal areas do. Households in formal and informal areas are most similar in terms of access to infrastructure (37% score for all households in formal areas, 36% in informal areas).

**Figure 3: Living Conditions Diamond**



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